Instructor:

Dr. Mariana Mateos  
Dept. of Wildlife and Fisheries Sciences  
979-847-9463  
mmateos@tamu.edu (please always state “Molecular Evolution” in the subject line, and DO NOT send email via eLearning)  
Office Hours at 320B Old Herman Heep Bldg. (HLB) by appointment.

Level = 6

Course Description: Examine the theory and tools used in the analysis of molecular evolutionary patterns of DNA and protein sequences. Format combines lecture presentations by instructor, discussion of relevant scientific literature, computer exercises, preparation of research proposal or independent research project, oral presentations, and practice in peer-review process.

Prerequisites: Basic courses in general Genetics, in Evolution, and in Statistics; preferably more advanced courses such as phylogenetics and population genetics.

Learning Outcomes:  
At the end of the course students should be able to: (1) explain how the forces of evolution act at the molecular level; (2) apply a diversity of molecular evolution computational methods to analyze and interpret molecular evolutionary patterns; (3) critically analyze and evaluate current research and the work of peers (including written reviews); (4) prepare high quality research manuscripts for peer-reviewed scientific journals and/or high quality research proposals for funding agencies such as NSF; and (5) deliver concise and coherent oral arguments and research presentations.

To provide students with the theoretical background and practical tools background and hands-on experience utilized in molecular evolution studies. In addition, students will practice important skills such as critical thinking, manuscript and proposal writing, peer-review, and public presentation.

Course information:  
Class meets:  
- Lecture on: MW 12:40–01:30PM Nagle 104  
- Lab on: F 9AM–12PM (Old Heep 311; Main Campus)
Course credit:

3 semester hours, based on two one-hour lectures per week and one three-hour laboratory/discussion session per week.

Textbook (Optional; freely available online at eBrary for a few simultaneous users):


Additional Recommended Books


Course Web Site: eLearning (access through Howdy or elearning.tamu.edu)

The content of the website is password protected for copyright reasons. Please do not make material available to people who are not registered in this course.

Grading

[91–100% = A; 81–90% = B; 71–80% = C; 61–70 = D; ≤ 60 = F]

Grades will be based on:
- Final project proposal and in-class presentation (5%)
- First Submission of Final paper and in-class presentation (10%)
- Written review of peers’ (including written feedback on presentations) (10%)
- Final Paper (35%)
- Final Paper in-class Presentation (10%)
- Homework/lab assignments (15%)
- Class participation (includes leading paper discussions and submission of discussion questions prior to class) (15%)

Late submissions will incur in grade penalties.
I will be tough on non-participation or mediocre participation.

Final project guidelines will be provided in a separate document.

Attendance:

Attendance to lectures and labs is compulsory. Student should inform me as soon as possible if he/she plans to miss (or has missed due to unforeseen university-sanctioned reasons) a lecture or lab/discussion. Assignments will be given during lectures. Student is responsible for assignments even if he/she did not attend lecture during which the assignment was given, unless other arrangements have been made with the instructor. Each student will be responsible for
leading the discussion of several papers throughout the semester, which will be assigned by me.

Discussion participation: you will be expected to hand in via email or hardcopy at least three discussion points/questions regarding each paper to be discussed, prior to the discussion session. Questions that just reflect ignorance of the topic will not be accepted. Nevertheless, part of the discussion session can be used to clarify concepts.

Americans with Disabilities Act (ADA) Policy Statement

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities, in Cain Hall, Room B118, or call 845-1637. For additional information visit http://disability.tamu.edu.

Academic Integrity Statement and Policy:
“An Aggie does not lie, cheat, or steal or tolerate those who do.”

Course Schedule (Subject to Change)

Week 1 (Jan 14)
Lecture: Introduction to course (Chapters 1 and 3)
Other (optional) Readings:
Basic Intro/Review of “Neutral Theory: The Null Hypothesis of Molecular Evolution”

Lab (Chapter 2): request accounts in brazos cluster; learn to download sequences from Databases; basic unix commands; alignment

Week 2 (Jan 21):
No class on Monday: MLK Holiday
Lecture: Dynamics of genes in populations (Chapter 13; section 13.1)

Lab: ~8 min presentations (+ ~2 min for questions) on proposed final project

Week 3 (Jan 28)
Due date Wed Jan 30: One-page final project proposal due via email at 5PM
Lecture: Evolutionary change in nucleotide sequences (Chapter 4)
Introduction to Phylogenetics (Chapters 5–8)

Lab or Discussion:
Option 1: three papers TBD (suggestions: comparison of methods, rooting, long-branch attraction; star-tree paradox).
Option 2: Molecular Phylogenetics lab exercise.
Week 4 (Feb 4)
Lecture: Natural selection and adaptation of molecular sequences (Chapters 13 and 14)

Other Readings (tentative):
- Pagel and A. Pomiankowski (Chapter 11)
Lab: Detecting positive selection (PAML)

Week 5 (Feb 11)
Lecture: Molecular dating: relaxed molecular clocks (Chapter 11)
Other Readings: TBD (one Discussion)
Lab: BEAST and/or MULTIDIVTIME (Chapters 18 and 19)

Week 6 (Feb 18)
Lecture: DNA Polymorphism in populations: Introduction to the Coalescent (Chapter 17)
Other Readings: TBD
Lab/Discussion: TBD (3 Discussion papers)

Week 7 (Feb 25)
No class on Monday: Assignment TBD
Lecture: Inferring species trees from gene trees
Readings: TBD
Lab: BEST/*BEAST/BUCKy

Week 8 (Mar 4)
Lecture: DNA Polymorphism in populations: Population structure/demography (coalescence) (Chapter 19)
Other Readings: TBD (one discussion paper)
Lab: MIGRATE-N (and IMA?)

Week 10 (NO CLASSES)
Spring Break: March 11-15

Week 11 (Mar 18)
**Due date Mon Mar 18: Final project (First Submission) due via email at 5PM**

Friday Mar 22: No lab/discussion. Students MUST attend Ecological Integration Symposium and provide a one-paragraph summary and critique of each of the talks during presented during class period (due following Wed 5 PM). This will count as one assignment.
Lecture: DNA Polymorphism in populations: Recombination (coalescence)
Readings: TBD (one paper discussion)

Week 12 (Mar 25)
**Due date Tue Mar 26:** Written reviews of peer final projects due via email at 5PM
No class on Friday (Reading day)
Evolution by Gene Duplication, Exon Shuffling and Concerted Evolution
Readings: Pagel and Pomianowsky Chapter 3 (one paper discussion)

Week 13 (Apr 1)
Lecture: Evolution by transposition and horizontal transfer
Readings:
- **Wed:** Pagel and Pomianowsky (eds) Chapter 4 “Lateral Gene Transfer”

Friday: No Lab (Discussion) 2–3 papers TBD

Week 14 (Apr 8)
Lecture: Genome Organization and Evolution
Readings: TBD
Lab/Discussion: No Lab (Discussion) 2–3 papers TBD

Week 15 (Apr 15)
Lecture/Lab/Discussions: Open topic/consulting for final projects; one suggestion:
detecting introgression

Week 16 (Apr 29)
Monday Apr 29: Course evaluations; Feedback
**Due date: Tuesday Apr 30 (Redefined Friday): ~10 min Final Project Presentations**

Week 17 (May 6)
Final project due via email no later than Mon May 6th 5PM.